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A sound brand name: The role of voiced consonants in pharmaceutical branding

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Highlights

- Sound symbolism provides a useful framework when developing pharmaceutical brand name
- Voiced (vs. voiceless) consonants in brand names increase expected efficacy of medicine
- Perceived potency and activity mediate the effect of voiced sound on medicine's expected qualities

ABSTRACT

Given the worldwide growth of the over-the-counter (OTC) drug market and the increase in the direct-to-consumer advertising of medicines, pharmaceutical branding has become an increasingly important component affecting the consumer's beliefs about, and hence their responses towards, OTC medicines. The brand name is one of the most important external cues for brand evaluation and influences various aspects of consumer-brand association (e.g., perceived quality/efficacy, brand attitude, and brand image). Although sound symbolism, which refers to the non-arbitrary association that exists between particular sound sequences and specific meanings in speech, has proven to be an effective means of creating successful brand names in a wide range of products, surprisingly little attention has been paid to its application in the case of pharmaceutical branding. In this study, we systematically investigated whether and how consonants in drug brand names influence consumers' medicine expectancies (e.g., medicinal power, long-lasting efficacy). Across three experiments, a robust effect of voiced (vs. voiceless) consonants present in brand names on the perceived potency and activity for target medicines was found. In addition, the results also revealed that voiced (vs. voiceless) consonants increase the expectancies of medicine effectiveness, duration of medicine activity, price, and potential side effects. Furthermore, we found that the perceived potency and activity for brand names significantly mediated the effect of voiced consonants. Taken together, these findings enhance our understanding of the role of consonant sound symbolism in brand name development and can potentially help pharmaceutical firms to create appropriate brand names that can effectively communicate information concerning a medicine's properties.

Keywords: Consonant sound symbolism; Pharmaceutical brand names; Medicine expectancies; Sensory marketing.

1. Introduction

Imagine a consumer who suffers from severe hay fever inspecting a couple of over-the-counter (OTC) anti-allergy drugs, one named "Sanasas" and the other "Danadas". Which one would likely appeal more to the consumer, all other things being equal? According to the results of the research reported here, they would probably prefer "Danadas", as the speech sounds present in the brand name are more potent and active, thereby conveying an impression of a more powerful and longer-lasting medicine.

With the rapid growth in direct-to-consumer advertising in the pharmaceutical industry, branding and marketing have become increasingly important elements in terms of setting the right expectations in the mind of the consumer. In 2018, the global OTC drug market exceeded USD 125 bn. and is forecast to grow to USD 185 bn. by the year 2025 (Global Market Insight, 2019). With the competition intensifying, more and more companies are offering their drugs as OTC products in retail outlets, supermarkets, and even online stores. Like many other packaged food and beverage products, the consumer's perception of OTC drugs is influenced by a variety of external cues such as advertising, packaging, and even the brand name.

Although published research on pharmaceutical branding is still in its infancy, there is plenty of evidence to suggest that various extrinsic cues such as packaging (e.g., Kauppinen-Räisänen, 2010; Roulette & Droulers, 2005), brand name (e.g., Dohle & Siegrist, 2014; McNeil, 2003), and pill color and shape (e.g., Bakalar, 2012; Wan, Woods, Velasco, Salgado-Montejo, & Spence, 2015) can all influence a consumer's product expectations and perception. For example, Roulette and Droulers (2005) demonstrated that the use of dark colors in pharmaceutical packaging helps to convey the impression of higher potency. Meanwhile, Dohle and Siegrist (2014) demonstrated that the processing fluency of drug names (e.g., hard-to-read vs. easy-to-read) can affect the consumer's impression of the associated drug risks as

well as their willingness-to-pay (WTP) for the product. More relevant specifically to the current research, Abel and Glinert (2008) indicated that the brand names of commercial chemotherapy drugs contain more voiceless consonants (e.g., [p], [s]; thought to be associated with fastness and lightness) than voiced consonants (e.g., [b], [z]; thought to be associated with slowness and heaviness). Through the survey, they speculated that as the treatment of chemotherapy is accompanied in many patients by a strong sense of trepidation, hence the sounds of chemotherapy names that are associated with lightness, smallness, and fastness may help to mitigate concerns about side effects and/or result in better treatment experiences. The current research focuses on the product expectations that are associated with specific brand names. In particular, we investigated the influence of sounds contained in a pharmaceutical brand name (i.e., sound symbolism) on the consumers' expectations concerning the product's qualities and efficacy.

The brand name is widely recognized as one of the most important external cues for brand evaluation including perceived quality (Dawar & Parker, 1994; Klink, 2000; Kohli & LaBahn, 1997; Wänke, Herrmann, & Schaffner, 2007), brand attitude (Klink, 2001, 2003; Zinkhan & Martin, 1987), and brand image (Del Río, Vázquez, & Iglesias 2001; Pavia & Costa, 1993). The effective use of sound symbolism has been shown to provide an effective means of creating successful brand names across a wide-range of products (Klink, 2001; Spence, 2012). However, with few exceptions (e.g., Abel & Glinert, 2008), surprisingly little attention has been paid to the application of the sound symbolic framework to the development of pharmaceutical brand names. The current research aims to bridge this gap and investigate the effect of the presence (vs. absence) of certain consonants in pharmaceutical brand names on the expectations of consumers.

1.1. Sound symbolism and brand names

Sound symbolism refers to the non-arbitrary mappings that exist between phonetic properties of speech sounds and their meanings (e.g., Knoferle, Li, Maggioni, & Spence, 2017; Sidhu & Pexman, 2018). The effect of incorporating sound symbolic features in brand names on the perception of consumers has been demonstrated across a wide range of product categories from durable goods (e.g., cars, laptops), daily goods (e.g., toilet paper, toilet cleaner), and fashion items (e.g., dresses, cologne) through to foods and beverages (e.g., ice cream, beer, and chocolate; e.g., Arroyo & Arboleda, 2020; Klink, 2000; Klink & Wu, 2014; Lowrey & Shrum, 2007; Pathak, Calvert, & Lim, 2020; Pathak, Calvert, & Motoki, 2020; Spence, 2014; Yorkston & Menon, 2004).

A considerable body of research links the vowels present in the brand names with specific product attributes. For example, front vowels (e.g., the sound of [i], [e]) are perceived as smaller, lighter, brighter, more feminine and less creamy (Klink, 2000; Yorkston & Menon, 2004), whereas back vowels (e.g., the sound of [o], [u]) are perceived as larger, heavier, darker, creamier and more masculine (e.g., Lowrey & Shrum, 2007; Klink, 2000; Klink & Athaide, 2012; Yorkston & Menon, 2004).

Compared to vowels, less attention has so far been paid to the role of consonant sounds in sound symbolism and brand name development (Guèvremont & Grohmann, 2015). Consonants can be categorized into voiceless or voiced in terms of the type of voicing (Klink, 2000; Sidhu & Pexman, 2018). A voiceless consonant is produced without any vibration of the vocal cords (e.g., [f], [s], [p], [t]), whereas a voiced consonant is made with the accompanying vibrations of the vocal cords (e.g., [v], [z], [b], [d]). Voiceless/voiced consonants can be further subdivided into fricatives and stops (Sidhu & Pexman, 2018). A fricative consonant is produced by squeezing air between a small gap as it leaves the mouth and has less closure of the articulators than a stop sound. On the other hand, the sound of a stop consonant is produced by

complete closure of the articulators so that all airflow ceases in the mouth. Sounds such as [f], [s], and [v], [z] are voiceless and voiced fricatives, respectively. Meanwhile, sounds such as [p], [t], and [b], [d] are considered as voiceless and voiced stops, respectively. Although research on the topic of sound symbolism associated with consonants is relatively sparse, a few studies have examined the frequency of consonants appearing in famous brand names (Pathak, Velasco, & Spence, 2020; Van Doorn, Paton, & Spence, 2016) as well as the influence of consonant sounds in brand names on the response of consumers (Guevrèmont & Grohmann, 2015; Motoki et al., 2020; Pathak, Calvert, & Lim, 2020). For instance, Pathak et al. (2020) found that consumers perceive products (e.g., beer, toilet cleaner) with brand names that include voiced (vs. voiceless) consonants as having stronger and hasher product attributes (e.g., strong beer).

1.2. Voiced consonants and pharmaceutical branding

Osgood's three dimensions of connotative meaning (i.e., evaluation, potency, and activity) were used to examine the influence of consonant sounds in brand names on consumer impressions of medicines (Osgood, Suci, & Tannenbaum, 1957; Tannenbaum, Jacobson, & Norris, 1964). The evaluation dimension can be measured with bipolar items such as "nice–awful", and "good–bad". Meanwhile, the dimensions of potency and activity are typically assessed using items such as "powerless–powerful", "weak–strong" and "slow–fast", "passive–active", respectively. Osgood's three dimensions of connotative meaning have been applied in a variety of contexts such as color (Valdez & Mehrabian, 1994), angularity (Velasco, Woods, Marks, Cheok, & Spence, 2016), typeface (Doyle & Bottomley, 2006), and packaging (Roullet & Droulers, 2005). Specifically, Sidhu and Pexman (2018) suggested that the effects of sound symbolism emerge due to the connotative meanings inherent to the sounds (e.g., sounds related to taste can be also be described as 'sharp', though sharpness is literally a

dimension related to shape). Thus, it would seem reasonable to expect the effect of sound symbolism in pharmaceutical branding due to the connotative meanings of these sounds.

Research in sound symbolism suggests that voiced (vs. voiceless) consonants are linked to impressions related to potency (e.g., strong, powerful). Since words or names with voiced (vs. voiceless) consonants are perceived to be larger, heavier, stronger, and more masculine (Pathak et al., 2020; Shih, Ackerman, Hermalin, Inkelas, & Kavitskaya, 2018; Slepian & Galinsky, 2016), we expected that the perceived potency of medicines would be higher (vs. lower) when the brand names contain voiced (vs. voiceless) consonants.

Compared to potency, it is rather difficult to predict the effect of voicing on the perception of the activity dimension (e.g., fast, active). Since voiceless consonants are more closely associated with fastness than voiced consonants (e.g., Abel & Glinert, 2008; Klink, 2000), voiced (vs. voiceless) consonants in brand names can decrease the perception of activity. At the same time, however, it should be noted that the potency and activity dimensions are not perfectly orthogonal and may integrate into the dimension of "dynamism" (Kervyn, Fiske, & Yzerbyt, 2013; Osgood et al., 1957). Given that the potency and activity dimensions are positively related, we expected that, as with the potency dimension, voiced (vs. voiceless) brand names might increase the perceived activity of the medicines.

Voiced (vs. voiceless) sounds are associated more with negative concepts such as dirtiness and ugliness and perceived as less pleasing (Fjeldsted, 1991; Motoki et al. 2020; Pathak et al., 2020). For instance, Motoki et al. (2020) reported that foods are perceived more favorably when those names contain voiceless consonants rather than voiced ones. Thus, it was expected that the perceived evaluation for medicines will be lower when the brand names contain voiced, rather than voiceless, consonants.

2. Experiment 1

The purpose of Experiment 1 was to examine the effect of voiced sounds present in brand names on the ratings of medicine using Osgood's semantic differential scale. Specifically, we examined whether voiced (vs. voiceless) consonants would influence the rated EPA dimensions (evaluation, potency, and activity) of a hypothetical new anti-allergy medicine.[1]

2.1. Method

2.1.1. Design and participants

The experiment was a 2 (type of voicing: voiceless, voiced) × 2 (manner of articulation: fricative, stop) between-participants design. The dependent variable was ratings of twelve seven-point bipolar Osgood's EPA measurements (Osgood, 1964; Osgood et al., 1957) adapted from Velasco et al. (2016).

The participants in all three of the experiments were recruited online from Yahoo Crowd Sourcing service (https://crowdsourcing.yahoo.co.jp/) provided by Yahoo! Japan Corporation and completed the questionnaire on Survey Monkey (https://www.surveymonkey.com/). All three of the experiments that are reported here were conducted in accordance with the ethical guidelines of the first author's university and the Declaration of Helsinki. Two hundred and twenty-eight respondents participated in Experiment 1 (77 females, mean age of 46.9 years, SD = 10.4)[2] and received a point worth 20 JPY as compensation.

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[1] Anti-allergy medicine (Experiment 1), painkiller (Experiment 2), and stomach relief (Experiment 3) were chosen as target medicines as these are easily available OTC drugs that most consumers are likely to be at least somewhat familiar with.

[2] *A priori* power analyses using G*power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) for all experimental designs indicated that the number of recruited participants in each study was sufficient to detect a medium effect size (f = 0.25) with 95% power at an alpha level of .05 as recommended for behavioral studies (Cohen, 2013).

2.1.2. Stimuli

Four fictitious brand names were created using a voiceless and voiced fricative (i.e., [f], [v]) and a voiceless and voiced stop (i.e., [p], [b]), while controlling for other sounds in the names: FANTEC, VANTEC, PANTEC, and BANTEC.

2.1.3. Procedure

At the start of the experiment, the participants were welcomed and it was explained that the study concerned an OTC medicine. After providing their consent, the participants were randomly assigned to one of four brand name conditions. First, they were informed that a pharmaceutical company had developed an anti-allergy medicine named "_____ (indicated one of FANTEC, VANTEC, PANTEC, or BANTEC)". Subsequently, participants rated the medicine on twelve seven-point bipolar semantic differential EPA items across three dimensions, 1) evaluation; including nice–awful, good–bad, mild–harsh, and happy–sad (α = .87), 2) potency; including powerless–powerful, weak–strong, light–heavy, and shallow–deep (α = .79) and, 3) activity; including slow–fast, quiet–noisy, passive–active, and dead–alive (α = .72). At the end of the study, the participants reported their gender and age.

2.2. Results

Three two-way analyses of variance (ANOVAs) were conducted for the EPA dimensions (see Figure 1). The results of the analysis of the evaluation dimension indicated a significant main effect of the type of voicing (voiceless vs. voiced), ($F(1, 224) = 6.51$, $p = .011$, $\eta_p^2 = .028$). However, contrary to our predictions, the perceived evaluation of the medicine was higher in the voiced (vs. voiceless) name condition ($M_{voiced} = 4.39$, $SD = 0.85$; $M_{voiceless} = 4.14$, $SD = .71$). Meanwhile, the main effect of the manner of articulation (fricative vs. stop) was not

significant ($F(1, 224) = 1.58$, $p = .21$, $\eta_p^2 = .01$), nor was there any interaction between the type of voicing and the manner of articulation either ($F(1, 224) = 3.08$, $p = .08$, $\eta_p^2 = .01$).

The results of the ANOVA regarding potency revealed a significant main effect of the type of voicing ($F(1, 224) = 12.15$, $p < .001$, $\eta_p^2 = .05$). As expected, brand names incorporating voiced (vs. voiceless) consonants induced higher perceived activity for the medicine ($M_{voiced} = 4.49$, $SD = 0.78$; $M_{voiceless} = 4.15$, $SD = 0.71$). On the other hand, neither the main effect of the manner of articulation, nor the interaction between the type of voicing and the manner of articulation, were significant (all $Fs < 1.56$, $ps > .21$).

The results of the activity dimension highlighted significant main effect of the type of voicing ($F(1, 224) = 12.78$, $p < .001$, $\eta_p^2 = .05$). Voiced (vs. voiceless) brand names, as expected, resulted in higher perceived activity for the medicine ($M_{voiced} = 4.43$, $SD = 0.78$; $M_{voiceless} = 4.11$, $SD = 0.63$). Meanwhile, no significant main effect of the manner of articulation nor any interaction between the type of voicing and the manner of articulation were found (all $Fs < 1.58$, $ps > .11$).

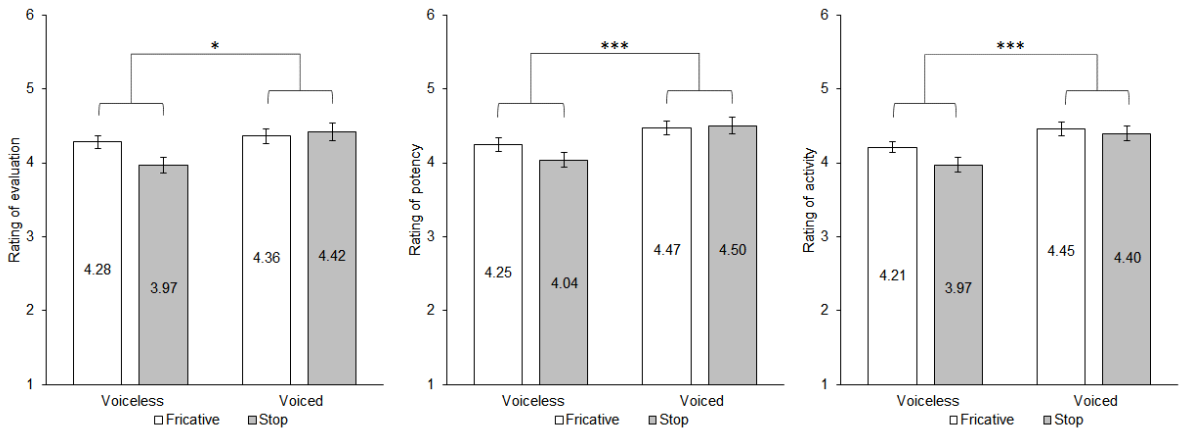

Fig. 1. Results of perceived evaluation, potency, and activity of the medicine in Experiment 1. Note: Error bars indicate standard errors of mean. Asterisks indicate post-hoc significant differences by Tukey test. * denotes $p < .05$, *** denotes $p < .001$.

2.3. Discussion

The results of Experiment 1 revealed that brand names containing voiced (vs. voiceless) consonants increased the rated evaluation, potency, and activity of a hypothetical new anti-allergy medicine. Meanwhile, the presence of stop (vs. fricative) consonants in the brand names did not influence ratings for any of the dimensions. Additionally, no significant interaction between voiced and stop consonants was documented for any of the three dimensions.

3. Experiment 2

Experiment 2 was designed to examine the effect of voiced consonants in brand names on consumers' EPA ratings of a medicine in a more realistic setting. To do this, we tested the effect of voiced sounds on consumer responses to a medicine using brand packaging for a painkiller.

3.1. Method

3.1.1. Design and participants

The experimental design was a 2 (type of voicing: voiceless, voiced) × 2 (manner of articulation: fricative, stop) between-participants design. The dependent variable was the same ratings of EPA dimensions as used in Experiment 1.

Two hundred and nineteen respondents took part in Experiment 2 (94 females, mean age of 46.3 years, SD = 10.1) and received a point worth 20 JPY as compensation.

3.1.2. Stimuli

Four versions of fictitious painkiller packages were created with brand names that included one of four consonants (i.e., [f], [v], [p], [b]) used in Experiment 1 (see Table 1).

Table 1. The package stimuli used in Experiment 2.

		Voiceless		Voiced	
Fricative	*f*		*v*	
Stop	*p*		*b*	

3.1.3. Procedure

The procedure was similar to that used in Experiment 1, except that instead of text stimuli, participants were shown color images of product packages. First, they were presented with the image of the packaging of drugs and it was explained that the product was a painkiller that had been recently developed by a pharmaceutical company. Subsequently, the participants rated the painkiller on the same 12 bipolar EPA items used in Experiment 1 (evaluation, α = .81; potency, α = .90; activity, α = .77).

3.2. Results

Three two-way ANOVAs were performed for each of the EPA dimensions (see Figure 2). The results of the evaluation dimension indicated no significant main effects of voicing type ($F(1, 215) = 1.786$, $p = .18$, $\eta_p^2 = .01$) or manner of articulation ($F < 1$, $p = .51$), nor any interaction between these two factors ($F < 1$, $p = .89$).

The results of the potency dimension revealed a significant main effect of the type of voicing ($F(1, 215) = 9.62$, $p = .002$, $\eta_p^2 = .043$). Consistent with the results of Experiment 1, those drugs with voiced (vs. voiceless) brand names resulted in higher perceived potency for the medicine ($M_{voiced} = 4.26$, $SD = 0.95$; $M_{voiceless} = 3.85$, $SD = 0.95$). On the other hand, there was no main effect of the manner of articulation, nor any interaction between the type of voicing and the manner of articulation (all $Fs < 1$, $ps > .42$). Regarding the activity dimension, the results revealed a significant main effect of the type of voicing ($F(1, 215) = 4.42$, $p < .001$, $\eta_p^2 = .02$). As expected, and consistent with the results of Experiment 1, the perceived activity of the medicine was higher in the voiced ($M = 4.10$, $SD = 0.82$) than in the voiceless name condition ($M = 3.87$, $SD = 0.84$). Meanwhile, neither a significant main effect of the manner of articulation nor a significant interaction between the type of voicing and the manner of articulation was found (all $Fs < 1.08$, $ps > .31$).

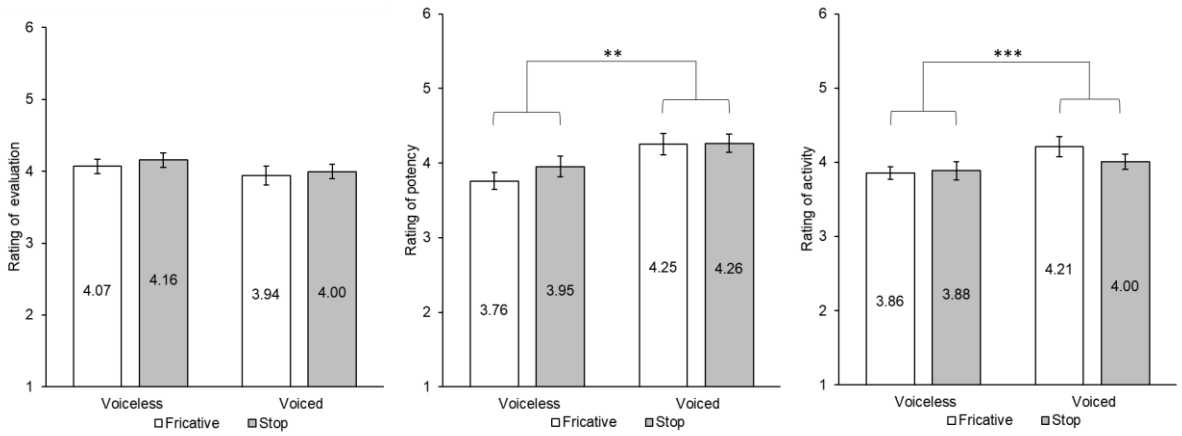

Fig. 2. Results of Experiment 2. Note: Error bars indicate standard errors. Asterisks indicate post-hoc significant differences by Tukey test. ** denotes $p < .01$, *** denotes $p < .001$.

3.3. Discussion

The results of Experiment 2 replicated the findings of Experiment 1 and demonstrated that brand names with voiced (vs. voiceless) consonants are perceived as having higher potency and activity for a packaged painkiller. However, inconsistent with the results of Experiment 1, the type of voicing did not influence ratings of the perceived evaluation of the medicine. Meanwhile, as with Experiment 1, stop (vs. fricative) consonants in the brand names did not affect the ratings of the various EPA dimensions. No significant interactions between voiced consonants and stops were observed for any of the three dimensions.

4. Experiment 3

Experiment 3 was designed to examine the effect of the voiced consonants present in brand names on the expected properties of medicines and the underlying mechanisms behind the effect. Specifically, we investigated whether, and how, the rated EPA for the brand names mediated the influence of voiced sounds in brand names on the expectations of consumers.

To measure the expectations that people have with hypothetical new medicines, we partially used the drug expectancy measurements of Roullet and Droulers (2005), consisting of the expectations of medicine effectiveness, duration of drug activity, price, and potential side effects. Voiced (vs. voiceless) consonants are, as stated above, perceived to be heavier, stronger, and more masculine. Thus, we predicted that they would be perceived as having a greater medicinal effectiveness, longer-lasting effectiveness, and also possibly more potential side effects. The concept of heaviness (vs. lightness) is metaphorically linked to higher perception of value (Ackerman, Nocera, & Bargh, 2010; Piqueras-Fiszman & Spence, 2012; Zhang & Li, 2012). Thus, it was expected that medicine with brand names containing voiced (vs. voiceless) consonants will also be perceived as more expensive.

To examine the effect of consonant sound in brand names more broadly, in addition to the labial consonants (i.e., [f], [v], [p], [b]) used in Experiments 1 and 2, coronal consonants (i.e., [s], [z], [t], [d]) were also used in Experiment 3. While a labial sound is produced with the lips, the sound of a coronal consonant is produced with the tongue. A number of studies have shown that labial consonants are associated with 'baby-ness' and consequently are associated with smallness (Kumagami & Kawahara, 2018; Shih, Ackerman, Hermalin, Inkelas, & Kavitskaya, 2018). These studies suggest that coronal consonants may associate more with size as compared to labials. Thus, we expected the effect of voiced brand names on medicine expectancies to be more prominent in coronal consonant conditions than in labial ones.

4.1. Method

4.1.1. Design and participants

The experimental design was a 2 (type of voicing: voiceless, voiced) × 2 (manner of articulation: fricative, stop) × 2 (place of pronunciation: labial, coronal) between-participants. The dependent variable was the same ratings of the EPA dimensions used in Experiments 1 and 2. Six hundred and nineteen-five respondents participated in Experiment 3 (366 females, mean age of 45.1 years, SD = 9.6). They received a point worth 25 JPY as compensation in return for completing the survey.

4.1.2. Stimuli

Eight versions of fictitious stomach relief packages were created with brand names using the above mentioned four labial consonants ([f], [p], [v], [b]) and four coronal consonants ([s], [t], [z], [d]) (see Table 2). The package design is identical to that used in Experiment 1 but to avoid the possible confounding effects of color, we used grayscale images. The eight brand names were Fanafas, Panapas, Vanavas, Banabas, Sanasas, Tanatas, Zanazas, and Danadas.

Table 2. The package stimuli used in Experiment 3.

	Voiceless		Voiced	
	Fricative	Stop	Fricative	Stop
Labial	*f* 	*p* 	*v* 	*b* 
Coronal	*s* 	*t* 	*z* 	*d* 

4.1.3. Procedure

The participants were randomly assigned to one of the eight package conditions. First, they were presented with a grayscale image of the drug package and it was explained that the drug was designed to provide relief for stomach pain and heartburn that had been recently developed by an unnamed pharmaceutical company. Subsequently, participants rated their impression of the brand name on the same 12 bipolar EPA items used in Experiments 1 and 2 (evaluation, $\alpha = .76$; potency, $\alpha = .88$; activity, $\alpha = .75$). Next, they rated the drug expectancies on five 7-point bipolar scales adapted from the work of Roullet and Droulers (2005). These items comprised: medicine effectiveness (weak-strong), duration of drug activity (short-long), price (cheap-expensive), and potential side effects (low-high).

4.2. Results

4.2.1. The effect of voicing on medicine expectancies

To examine the effect of voiced consonants in brand names on the evaluation of consumers' expectations concerning the properties of the medicine, four three-way ANOVAs were conducted with the type of voicing, manner of articulation, and the place of pronunciation

as independent variables and the items of the drug expectancies as dependent variables (see Appendix Table A for the mean ratings of all eight brand names).

4.2.1.1. Medicine effectiveness

The analysis regarding the expectation of medicine effectiveness revealed a significant main effect of the type of voicing ($F(1, 687) = 25.94$, $p < .001$, $\eta_p^2 = .04$): specifically, the drugs with voiced (vs. voiceless) brand names were perceived as being more effective ($M_{voiced} = 4.47$, $SD = 1.26$; $M_{voiceless} = 4.02$, $SD = 1.22$). On the other hand, the main effects of the manner of articulation ($F < 1$, $p = .35$), and the place of pronunciation ($F(1, 687) = 2.46$, $p = .20$, $\eta_p^2 = .00$), were not significant. There was a significant interaction between the type of voicing and the place of pronunciation ($F(1, 687) = 4.90$, $p = .027$, $\eta_p^2 = .01$): the effect of voiced (vs. voiceless) consonants in brand names on the expectations of our participants was greater when the names contained coronal consonants ($F(1, 687) = 26.28$, $p < .001$, $\eta_p^2 = .04$) than labial ones ($F(1, 687) = 4.22$, $p = .04$, $\eta_p^2 = .01$). The interactions between the type of voicing and the manner of articulation ($F < 1$, $p = .60$) and between the manner of articulation and the place of pronunciation ($F(1, 687) = 3.75$, $p = .053$, $\eta_p^2 = .01$) were not significant. The interaction term was qualified by a significant three-way interaction between the type of voicing, manner of articulation, and the place of pronunciation ($F(1, 687) = 4.16$, $p = .042$, $\eta_p^2 = .01$; see Figure 3). When the data were split into stop and fricative consonants, different interactions were observed. When the names included stop consonants, no significant interaction was found between the type of voicing and the place of pronunciation ($F < 1$, $p = .90$): voiced (vs. voiceless) consonants increased the perceived medicine power both in labial and coronal brand name groups (labials: $F(1, 347) = 6.63$, $p = .01$, $\eta_p^2 = .02$; coronals: $F(1, 347) = 9.58$, $p = .002$, $\eta_p^2 = .03$). However, when the names included fricative consonants, a significant interaction was identified between the type of voicing and the place of pronunciation

($F(1, 340) = 9.05$, $p = .003$, $\eta_p^2 = .03$): voiced (vs. voiceless) consonants in brand names increased the expected power in coronal name conditions but not in labial ones (labials: $F < 1$, $p = .87$; coronals: $F(1, 340) = 16.88$, $p < .001$, $\eta_p^2 = .05$).

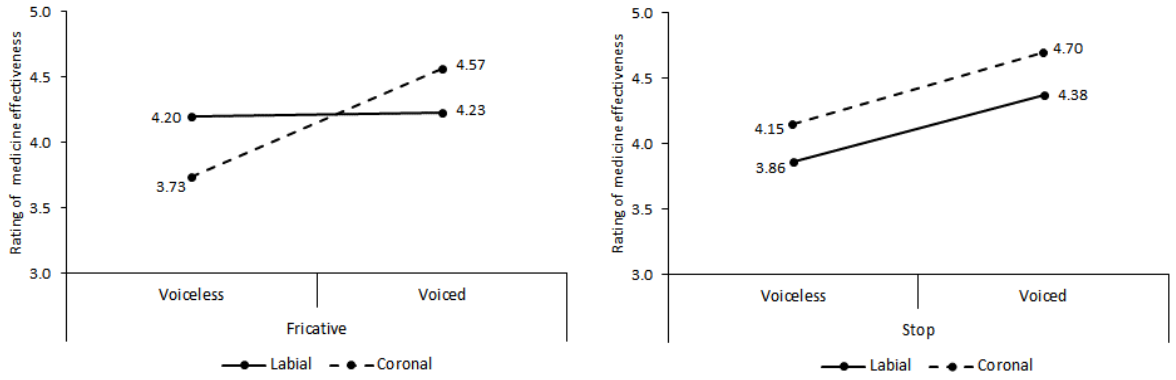

Fig. 3. The results of the influence of the consonants in brand names on the rating of medicine effectiveness in Experiment 3.

4.2.1.2. Perceived duration of medicine activity

The significant main effects of voiced (vs. voiceless) consonants and coronal (vs. labial) consonants on the perceived duration were observed: drugs with voiced (vs. voiceless) brand names ($F(1, 687) = 9.01$, $p = .003$, $\eta_p^2 = .01$; $M_{voiced} = 4.03$, $SD = 1.23$; $M_{voiceless} = 3.80$, $SD = 1.12$) and drugs with coronal (vs. labial) brand names ($F(1, 687) = 6.92$, $p = .009$, $\eta_p^2 = .01$; $M_{labial} = 3.81$, $SD = 1.10$; $M_{coronal} = 4.03$, $SD = 1.14$) were perceived as having a longer duration. Meanwhile, neither the main effect of the manner of articulation, nor any of the interactions, were significant (all $Fs < 1.68$, $ps > .20$). The three-way interaction between the type of voicing, the manner of articulation, and the place of pronunciation was not significant either ($F(1, 687) = 3.16$, $p = .076$, $\eta_p^2 = .02$; see Figure 4).

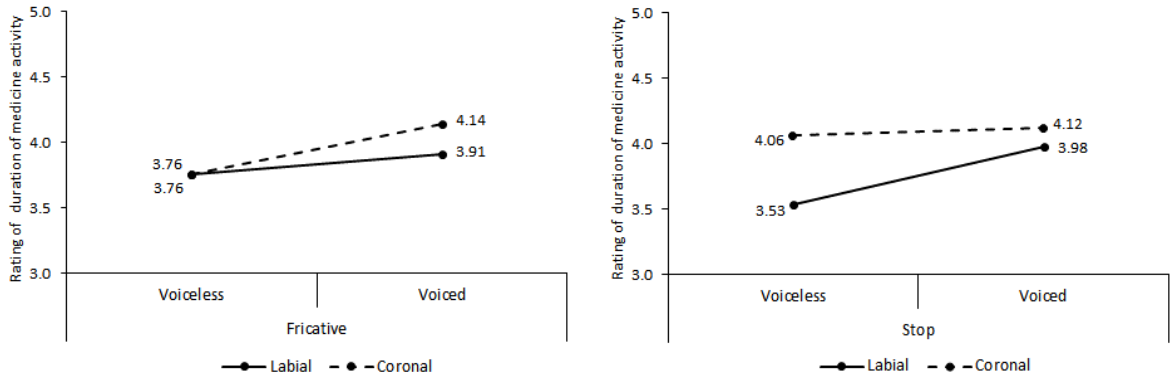

Fig. 4. The results of the influence of the consonants in brand names on the rating of duration of medicine activity in Experiment 3.

4.2.1.3. Price expectation

The main effect of voiced (vs. voiceless) consonants on the perceived price was significant ($F(1, 687) = 8.87$, $p = .003$, $\eta_p^2 = .01$): Medicines with voiced (vs. voiceless) brand names were perceived to be more expensive ($M_{voiced} = 4.12$, $SD = 1.20$; $M_{voiceless} = 3.87$, $SD = 1.17$). None of the other main effects or interactions were significant (all Fs < 1.55, $ps > .21$; see Figure 5).

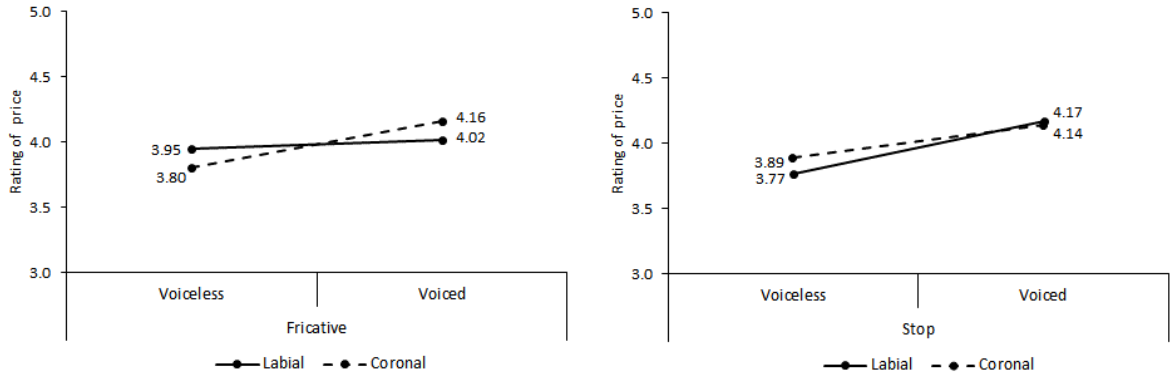

Fig. 5. The results of the influence of the consonants in brand names on the rating of medicine price in Experiment 3.

4.2.1.4. Potential side effects

The analysis revealed a significant main effect of the type of voicing ($F(1, 687) = 42.94$, $p < .001$, $\eta_p^2 = .06$): the drugs with voiced (vs. voiceless) brand names were perceived as having more potential side effects ($M_{voiced} = 4.06$, $SD = 1.11$; $M_{voiceless} = 3.55$, $SD = 1.06$). None of the other main effects or two-way interactions was significant (all Fs < 1, *ns*). In order to examine the significant three-way interaction ($F(1, 687) = 7.36$, $p = .007$, $\eta_p^2 = .01$) more closely, the data was split into stop and fricative consonants (see Figure 6). When the names included stop consonants, no significant interaction was found between the type of voicing and the place of pronunciation ($F(1, 347) = 1.71$, $p = .19$, $\eta_p^2 = .01$): voiced (vs. voiceless) consonants increased the perceived potential side effects regardless of the place of pronunciation (labials: $F(1, 347) = 14.48$, $p < .001$, $\eta_p^2 = .04$; coronals: $F(1, 347) = 5.44$, $p = .02$, $\eta_p^2 = .02$). However, when the names included fricative consonants, a significant interaction was observed between the type of voicing and the place of pronunciation ($F(1, 340) = 6.51$, $p = .014$, $\eta_p^2 = .02$): voiced (vs. voiceless) consonants in brand names increased the perceived side effects when they included coronal consonants (coronals: $F(1, 340) = 23.38$, $p < .001$, $\eta_p^2 = .06$), but this was not the case when those included labial ones (labials: $F(1, 340) = 3.32$, $p = .07$, $\eta_p^2 = .01$).

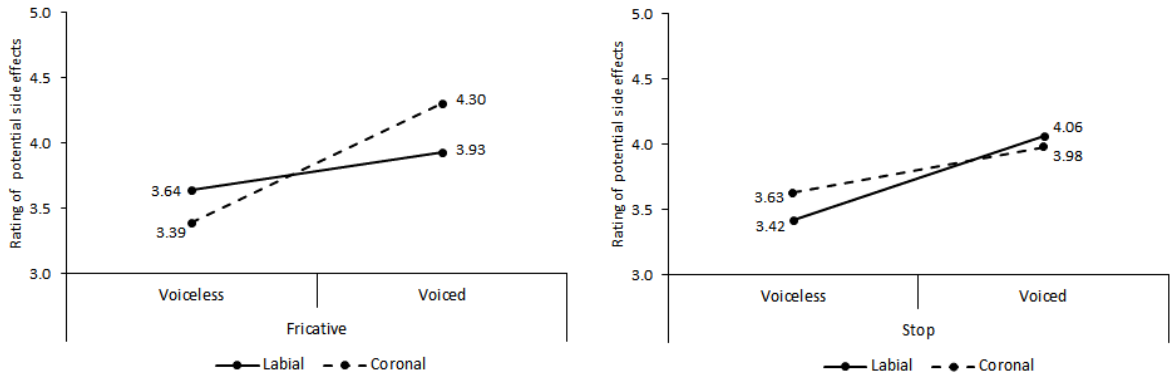

Fig. 6. The results of the influence of the consonants in brand names on the rating of potential side effects in Experiment 3.

Table 3. The result summary of the effect of consonants in brand names on medicine expectancies in Experiment 3. Note: ns denotes not significant, * denotes $p < .05$, ** denotes $p < .01$, *** denotes $p < .001$.

	Medicine effectiveness	Duration of medicine activity	Expected price	Potential side effects
Voiceless/voiced	***	**	**	***
Fricative/stop	ns	ns	ns	ns
Labial/coronal	ns	**	ns	ns
Voiceless/voiced × Fricative/stop	ns	ns	ns	ns
Voiceless/voiced × Labial/coronal	*	ns	ns	ns
Fricative/stop × Labial/coronal	ns	ns	ns	ns
Voiceless/voiced × Fricative/stop × Labial/coronal	*	ns	ns	**

4.2.2. The mediating role of rated EPA for the medicine expectancies

To examine whether and how the rated EPA for the various brand names mediated the effect of voiced (vs. voiceless) brand names on consumers' expectations regarding the medicines, parallel multiple mediation analyses were conducted for the four expectancies which were found to be influenced by voiced sounds in the brand names (i.e., medicine effectiveness, duration of medicine activity, price, and potential side effects) using Model 4 of the PROCESS SPSS macro (Hayes, 2018) with 5000 bootstrap samples (see Figure 7 and Table 4).

4.2.2.1. The mediating effect on medicine effectiveness

The results indicated that the total indirect effect of the voiced (vs. voiceless) brand name on the expected medicine effectiveness via the rated EPA was significant (total indirect effect = .40, 95% [0.26, 0.55]). The indirect effect via the evaluation showed a negative influence of voiced consonants on the rating of the expected medicine effectiveness (indirect effect = −.03, 95% [−0.06, 0.00]). Meanwhile, the indirect effect via the potency (indirect effect = .35, 95% [0.24, 0.47]) and the activity (indirect effect = .08, 95% [0.03, 0.14]) indicated the positive effect of voiced consonants on the expectation of the medicine's effectiveness. The direct effect of voiced consonants on the evaluation of the medicine effectiveness was not significant (direct effect = .04, 95% [−0.10, 0.18]).

4.2.2.2. The mediating effect on the expected duration of medicine activity

The total indirect effect of the voiced (vs. voiceless) brand name on the expected type of treatment via the rated EPA was significant (total indirect effect = .16, 95% [0.04, 0.27]). The indirect effect via the evaluation indicated a negative influence of voiced consonants on the expected duration of the medicine's activity (indirect effect = −.06, 95% [−0.12, −0.02]). Meanwhile, the indirect effect via the potency indicated the positive influence of voiced consonants on the expected activity duration (indirect effect = .20, 95% [0.12, 0.29]). The indirect effect via the activity showed no effect of voiced consonants on the expected activity duration (indirect effect = .01, 95% [−0.04, 0.07]). The direct effect of voiced consonants on ratings of how long-lasting the drug would be was not significant (direct effect = .08, 95% [−0.08, 0.23]).

4.2.2.3. The mediating effect on price expectation

The results revealed a significant total indirect effect of the voiced (vs. voiceless) consonants on the expected price through the rated EPA (total indirect effect = .28, 95% [0.18,

0.38]). The indirect effect of the evaluation dimension on price perception was not significant (indirect effect = .00, 95% [−0.02, 0.03]). Meanwhile, the indirect effect of rated potency (indirect effect = .20, 95% [0.12, 0.28]) and rated activity (indirect effect = .08, 95% [0.03, 0.15]) indicated the positive influence of voiced consonants on the price expectation of the medicine. The direct effect of voiced consonants on the expectation was not significant (direct effect = −.02, 95% [−0.19, 0.14]).

4.2.2.4. The mediating effect on expected potential side effects

Total indirect effect of the voiced (vs. voiceless) brand name on expected potential side effects via the rated EPA was significant (total indirect effect = .31, 95% [0.22, 0.41]). The indirect effect of the evaluation dimension showed a positive influence of voiced consonants on expected potential side effects (indirect effect = .05, 95% [0.01, 0.11]). Additionally, the indirect effect of potency (indirect effect = .19, 95% [0.12, 0.28]) and activity (indirect effect = .07, 95% [0.01, 0.13]) also indicated the positive influence of voiced consonants on the expected potential side effects. The direct effect of voiced consonants on the ratings of the side effects was found to be significant (direct effect = .20, 95% [0.05, 0.36]).

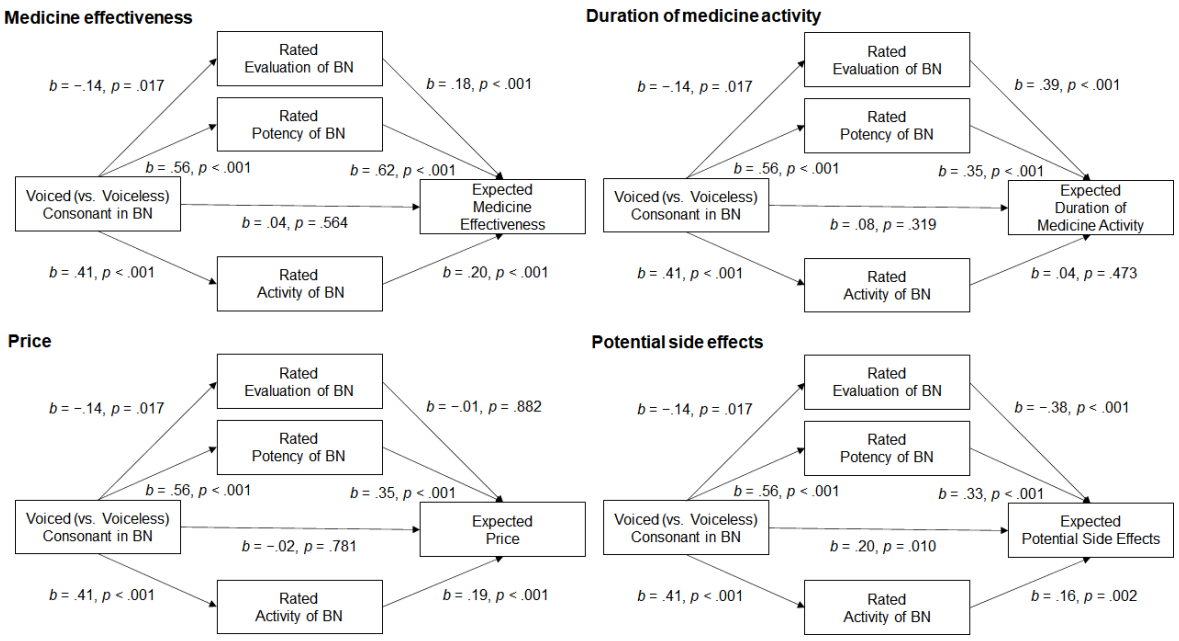

Fig. 7. The results of parallel mediation analyses in Experiment 3. Note: BN denotes brand name.

4.3. Discussion

Experiment 3 revealed a robust influence of voiced (vs. voiceless) consonants present in the brand names on medicine expectancies of the packaged stomach relief drugs. The results demonstrated that brand names with voiced (vs. voiceless) consonants increased people's expectations concerning the medicine's effectiveness, the duration of the medicine's activity, its price, and the occurrence of possible side effects. The results regarding the medicine's power also demonstrated that when the brand names contain stop (vs. fricative) and voiced (vs. voiceless) consonants, the expected effectiveness of the drugs is increased, regardless of the consonant type (i.e., labial or coronal).

The results of Experiment 3 further demonstrated the mediating role of perceived impressions of brand names on the effect of voiced consonants on the medicine expectancies. The perceived potency of the brand names was the most influential mediator amongst Osgood's EPA dimensions (Osgood et al., 1957) and it significantly mediated the effect of voiced consonant on the perception of medicine effectiveness, duration of drug activity, price, and potential side effects. Rated activity also positively mediated the effect of voiced consonants on expectations concerning the medicine's effectiveness, price, and potential side effects. Meanwhile, the rated evaluation positively mediated the effect of voiced consonant on the expected potential side effects, however, it negatively mediated the effect on the expected effectiveness of the medicine, and the expected duration of the medicine's activity. The mediation effect of the evaluation on the price expectation was not significant.

Table 4. Statistical summaries of the influence of voiced consonants in brand names on medicine expectations in Experiment 3. Note: Effect estimates are unstandardized regression coefficients.

DV	Voiced consonant effect	Effect estimate	95% CI
Medicine effectiveness	Total effect	.45	[0.26, 0.63]
	Direct effect	.04	[-0.10, 0.18]
	Indrect effect	.40	[0.26 , 0.55]
	via Evaluation	-.03	[-0.06, 0.00]
	via Potency	.35	[0.24, 0.47]
	via Activity	.08	[0.03, 0.14]
Duration of medicine activity	Total effect	.23	[0.07, 0.40]
	Direct effect	.08	[-0.08, 0.23]
	Indrect effect	.16	[0.04, 0.27]
	via Evaluation	-.06	[-0.12, -0.01]
	via Potency	.20	[0.12, 0.29]
	via Activity	.01	[-0.04, 0.07]
Expected price	Total effect	.25	[0.08, 0.43]
	Direct effect	-.02	[-0.19 , 0.14]
	Indrect effect	.28	[0.18, 0.38]
	via Evaluation	.00	[-0.02, 0.03]
	via Potency	.20	[0.12, 0.28]
	via Activity	.08	[0.03, 0.15]
Potential side effects	Total effect	.51	[0.35, 0.67]
	Direct effect	.20	[0.05, 0.36]
	Indrect effect	.31	[0.22, 0.41]
	via Evaluation	.05	[0.01, 0.11]
	via Potency	.19	[0.12, 0.28]
	via Activity	.07	[0.01, 0.13]

5. General discussion

5.1. Summary of the study

With the worldwide growth in OTC drug market, pharmaceutical branding has become an increasingly important element in terms of building a competitive edge over competing brands and setting the right expectations in the mind of the consumer. The purpose of the

present study was to examine whether and how the consonant sounds of brand name influence consumer's expectations for OTC medicines. Sound symbolism literature concerning voiced consonants suggests that words containing voiced (vs. voiceless) consonants are perceived to be large, heavier, and harsher (e.g., Pathak et al., 2020; Slepian & Galinsky, 2016). Using Osgood's EPA semantic dimensions (Osgood et al., 1957), which enable to capture connotative meaning of target stimuli, we predicted that voiced (vs. voiceless) consonants in brand names would increase perceived potency and activity while decreasing the perceived evaluation for OTC drugs. We also expected that the effect of voiced (vs. voiceless) consonant names on medicine expectancies would be mediated by ratings of EPA dimensions.

The three experiments reported here investigated the effects of voiced consonants in brand names on the expected properties of hypothetical new OTC medicines. A robust effect of voiced (vs. voiceless) consonants was observed on the expected properties of the various medicines. The results of Experiment 1 provided the initial evidence that voiced (vs. voiceless) consonants in brand names increased ratings of Osgood's evaluation, potency, and activity dimensions for an anti-allergy medicine. Meanwhile, neither the main effects of stop (vs. fricative) consonants, nor the interaction between the type of voicing and the manner of articulation, was significant. In Experiment 2, the effect of voiced consonants in brand names was further examined by using realistic packaging stimuli for a pain reliever. The results were consistent with the findings of Experiment 1 regarding the rated potency and activity dimensions.

Experiment 3 explored the effect of voiced consonant in brand names on the medicinal expectancies and the underlying mechanisms using a third category of drug (one that provided stomach relief). The results revealed that brand names with voiced (vs. voiceless) consonants increase the expected efficacy of the medicine, how long-lasting it was expected to work for,

its expected price, and also the expected likelihood of potential side effects. Furthermore, we found that the effect of voiced consonants on medicinal expectancies is mediated by rated potency and activity for the brand names. The rated potency mediated the effect of voicing on the expected efficacy of the medicine, how long-lasting it is expected to work, its likely price, and the expected potential side effects. Although the overall effects were modest, the rated activity of the brand names also mediated the effect of voicing on the perception of medicine power, expensiveness, and possible side effects. Meanwhile, we found mixed results for the mediating effect of the evaluation dimension. The rated evaluation negatively mediated the effect of voicing on medicine effectiveness, duration of medicine activity, but the effect on potential side effects was positively mediated by the evaluation dimension. The rated evaluation did not significantly mediate the expected price.

5.2. Implications

5.2.1. Theoretical implications

A considerable body of research has shown that the sounds of brand names can elicit a variety of product-attribute associations regarding speed, size, strength, shape, sensory properties, and gender associations (e.g., Klink, 2000; Lowrey & Shrum, 2007; Spence, 2012, 2014). However, most of these findings have explored vowels while less attention has been paid to the role of consonant sounds in brand name development (Guèvremont & Grohmann, 2015; Pathak et al., 2020). The present study systematically examined the role of consonants in brand names on consumer responses and revealed that voiced (vs. voiceless) consonants can significantly alter a consumer's impressions and expectancies of medicines. More importantly, our research further demonstrated the underlying mechanism by which voiced consonants in brand names influences a consumer's expectations concerning a medicine's properties.

According to Frequency Code Hypothesis, first proposed by Ohala (1984, 1994), low-frequency sounds convey meanings such as largeness, aggressiveness. As voiced (vs. voiceless) consonants are articulated at low frequency, those sounds are thought to elicit the above-mentioned associations. Our research confirmed that voiced (vs. voiceless) sounds in brand names induce and intensify the semantic impressions of potency and activity. We also confirmed that these associations are significant mediators of the effect of voiced sounds on the medicine expectancies. Osgood's potency and activity dimensions may integrate into the "dynamism" dimension (Kervyn, Fiske, & Yzerbyt, 2013; Osgood et al., 1957). In this regard, it may be said that the dynamism association induced by voiced sounds are the primary cause of the effect of sound symbolism on expectations concerning a medicine's effectiveness. The current findings enhance our understanding of the mechanism of voiced sound effects on product evaluation and add to a growing body of literature on consonant sound symbolism.

5.2.2. Managerial implications

In line with the worldwide growth of the OTC drug market, an increasing number of competing brands have been continuously launched to the market in various types of medicines. As, in many cases, the active ingredients and the efficacies of branded OTC drugs in a product type are more or less the same (e.g., the brands of allergy medicines such as Allegra, Zyrtec, Claritin), extrinsic brand cues are of critical importance to build a competitive edge over the competing brands and have a great influence on consumers' decision-making of OTC medicines.

The results reported here clearly suggest that sound symbolism is a useful framework that can help the pharmaceutical firms to develop names that can effectively communicate the desired properties of a medicine. More specifically, our study shows that it is desirable to use voiced consonants (e.g., [b], [d]) rather than voiceless consonants (e.g., [f], [s]) in a brand name,

when marketers intend to emphasize medicine effectiveness and/or the duration of medicine activity of a target product. It is, though, also important to note that our results suggest the associative linkage between the sounds of voiced (vs. voiceless) consonants and the perception of higher (vs. lower) potential side effects. Therefore, if marketers want to emphasize a medicinal safety as a core benefit of a drug, they may strategically use voiceless consonants in the name of the drug for effective brand communication.

5.3. Limitations and directions for future research

One limitation of the current study is that we controlled vowels in brand name stimuli and therefore did not examine the possible effect of vowels and the interaction between consonants and vowels in brand names on the expected qualities of medicine. As a number of published sound symbolism studies have already demonstrated a robust effect of back (vs. front) vowels on the perceptions of largeness and heaviness (e.g., Klink, 2000, Lowrey & Shrum, 2007), it is expected that the type of vowel in brand names can also influence consumers' expectations concerning the likely properties of medicines. In addition, as vowels and consonants have interactive influence the perception of taste such as bitterness (e.g., Motoki et al., 2020), the combinations of vowels and consonants in brand names may also affect the medicine expectancies through expected taste qualities. Future research could address these issues.

Another limitation relates to the mixed results of the voiced consonant effect on the perceived evaluation. In our study, the evaluation dimension indicates perceived goodness of the brand name. Although previous studies suggest that voiced (vs. voiceless) sounds are perceived less favorably (e.g., Fjeldsted, 1991), and Experiment 3 of the present study confirmed such an effect, we found a more favorable attitude towards voiced (vs. voiceless) brand names in Experiment 1, and no effect of voiced consonants on the evaluation in

Experiment 2. This inconsistency in the pattern of results may well be taken to suggest that the perceived goodness of brand names is largely determined by how to embed and combine multiple sounds rather than the type of voicing itself in brand names. It would be interesting to examine under which conditions voiced consonants in brand names can induce perceived goodness.

The research reported here demonstrates the positive effect of voiced (vs. voiceless) consonants in brand name on consumer expectations for medicines such as the effectiveness and duration of activity of the medicine. However, the present study also indicates that voiced (vs. voiceless) consonants can increase the perception of potential side effects as well. Thus, it would be important and intriguing to explore whether it is ever possible to create brand names that can convey the meaning of high effectiveness and low potential side effects simultaneously. Study 1 of Klink and Wu (2014) shows that although the effect of sound symbolism on conveying brand meaning (e.g., largeness) is more robust when the embed is positioned in the first (vs. second) syllable in a brand name, the significant sound symbolism effect also exists in the second syllable. When we take this into consideration, embedding voiced consonant and/or back vowel in the first syllable and voiceless consonant and/or front vowel in the second syllable in a brand name might be a solution to create a pharmaceutical brand name that connotates effectiveness and gentleness at the same time.

Appendix Table A

Mean ratings of medicine expectancies in Experiment 3. Note: The values in parentheses are standard deviations.

	Voiceless				Voiced			
	Fricative		Stop		Fricative		Stop	
	Labial	Coronal	Labial	Coronal	Labial	Coronal	Labial	Coronal
	Fanafas	*Sanasas*	*Panapas*	*Tanatas*	Vanavas	Zanazas	*Banabas*	*Danadas*
Medicine effectiveness	4.20 (1.25)	3.73 (1.13)	3.86 (1.15)	4.15 (1.24)	4.23 (1.23)	4.57 (1.26)	4.38 (1.28)	4.70 (1.25)
Duration of medicine activity	3.76 (1.00)	3.76 (1.35)	3.53 (1.05)	4.06 (1.05)	3.91 (1.10)	4.14 (1.01)	3.98 (1.21)	4.12 (1.15)
Price	3.95 (1.22)	3.80 (1.26)	3.77 (0.97)	3.89 (1.10)	4.02 (1.25)	4.16 (1.27)	4.17 (1.06)	4.14 (1.22)
Potential side effects	3.64 (1.05)	3.39 (1.11)	3.42 (1.10)	3.63 (0.98)	3.93 (1.07)	4.30 (1.29)	4.06 (1.01)	3.98 (1.09)

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